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logous appearances of incommunicable colours presented by mother-of-pearl, which had hitherto baffled all previous attempts to explain them; but which now appear to be produced by occasional intermissions in the process by which the material of the shell is secreted and deposited in the progress of its formation.

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March 3, 1836.

The Rev. WILLIAM WHEWELL, M.A., Vice-President, in the Chair.

The Right Hon. the Earl of Minto and Joshua Field, Esq., were elected Fellows of the Society.

A paper was read, entitled, "Researches on the Tides. Fifth Series: On the Solar Inequality, and on the Diurnal Inequality of the Tides at Liverpool." By the Rev. William Whewell, F.R.S., Fellow of Trinity College, Cambridge.

The inequality both in the height and time of high water in the morning and evening tides of the same day, which varies according to a law depending on the time of the year, is termed by the author *the diurnal inequality*, because its cycle is one day. The existence of such an inequality has often been noticed by seamen and other observers; but its reality has only recently been confirmed by regular and measured observations; and its laws have never as yet been correctly laid down. The author gives an account of the observations now in progress at different ports, from which he expects they will be ascertained with great precision. He traces the correspondence of the observations of the diurnal inequality already made with the equilibrium theory; and remarks that the semi-diurnal tides, alternately greater and less, which are transmitted from the Southern Ocean to Liverpool, may be compared to the oscillations of a fluid mass: and that they are augmented by the action of the forces occurring at intervals equal to those of the oscillations. Hence the oscillations go on increasing for a considerable period after the forces have gone on diminishing, and reach their maximum a week after the forces have passed theirs.

The remaining sections of this paper are devoted to the investigation of the Solar inequalities at Liverpool. By carefully eliminating the Lunar effects, which the author is enabled to do by the aid of the preceding researches, he has determined the approximate circumstances of the Solar correction for the height. He has also obtained evidence of the existence, and some knowledge of the laws of the Solar inequalities of the times; and these inequalities, as thus discovered, are found to exhibit the same general agreement with the equilibrium theory which has been disclosed in all the inequalities hitherto detected. The results of the extensive observations now obtained are sufficiently precise to indicate the defects of our mathematical theories of hydrodynamics; and some of these are pointed out by the author, who remarks that although a short time ago the theory

was in advance of observation, at present observation is in advance of theory; which mathematicians are therefore called upon to remodel and perfect.

The author proceeds to consider the effect of the Moon's declination on the Tides at Liverpool; which, as before observed, it is necessary to eliminate, in order to obtain the Solar inequality; and gives an explanation of various formulæ and tables constructed for that object. He then investigates the laws of the solar inequalities, first, as to the heights; and secondly, as to the times of high water at Liverpool, by applying to them these methods of calculation.

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March 10, 1836.

FRANCIS BAILY, Esq., Vice-President, and Treas., in the Chair.

Edward John Johnson, Esq., Commander, R.N., was elected a Fellow of the Society.

“Report of Magnetic Experiments tried on board an Iron Steam-Vessel, by order of the Right Hon. the Lords Commissioners of the Admiralty.” By Edward J. Johnson, Esq., Commander, R.N., accompanied by plans of the vessel, and tables showing the horizontal deflection of the Magnetic Needle at different positions on board, together with the dip and magnetic intensity observed at those positions, and compared with that obtained on shore with the same instruments. Communicated by Captain Beaufort, R.N., F.R.S., Hydrographer to the Admiralty; by command of the Right Hon. the Lords Commissioners of the Admiralty.

This report commences with a description of the iron steam-vessel, the “Garryowen,” belonging to the City of Dublin Steam Packet Company, and built by the Messrs. Laird, of Liverpool. She is constructed of malleable iron, is 281 tons burthen, and draws only 5½ feet water, although the weight of iron in the hull, machinery, &c. is 180 tons.

This vessel was placed under the directions of the author, in Tarbert Bay, on the Shannon, on the 19th of October, 1835, for the purpose of investigating its local attractions on the compass. The methods which were adopted with that view are given; together with tables of the results of the several experiments, and plans of the various parts of the Garryowen. The horizontal deflections of the magnetic needle at different situations in the vessel were observed, for the purpose of ascertaining the most advantageous place for a steering compass, and also for the application of Professor Barlow's correcting plate: and the dip and intensity in these situations were, at the same time, noted.

An experiment is detailed, showing that where several magnetic needles, freely suspended, were placed upon the quay, in Tarbert Bay, and the vessel warped from the anchorage towards them, first with her head in that direction and then with her stern, opposite deflections were produced: in the first case all the needles showing a